1. Full title of the Project
The Project for Enhancement of Integrated Water Resources Management

2. Type of the Study (e.g. Master Plan, Feasibility Study, Detailed Design, etc.)
Master Plan

3. Categorization and its reason
   (1) Category: B
   (2) Reason:
       The project is not likely to have significant adverse impact on the environment under the JICA Guidelines for Environmental and Social Considerations (April, 2010) in terms of its sectors, characteristics and areas.

4. Agency or institution responsible for the implementation of the Project
   Water Resources Technical Organ (WRTO), Ministry of Water Resources, Irrigation and Electricity (MWRIE)

5. Outline of the Project (objectives, justification, location, proposed activities and scope of the study)
5.1 Objectives
   The objective of the Project is to improve water utilization for domestic, industrial, irrigation, hydropower and navigation purposes.

5.2 Location
   the Republic of the Sudan

5.3 Scope of the Project
   The scope of the Project would include the evaluation of water potential-demand balance in nationwide, identification and categorization of the challenges on water resources, implementation of the practice IWRM at field level and preparation of recommendations for practical strategy, legal and organizational framework for promoting IWRM.

5.3.1 Outputs
To evaluate water potential-demand balance in nationwide
To identify and categorize challenges on water resources
To practice IWRM at field level
To make recommendations for practical strategy, legal and organizational framework for promoting IWRM through the Output-1, 2, and 3.

5.3.2 Activities
Component 1: Federal Practice of IWRM
1.1 Review of Legal and Organizational Framework
(1) Review of legal framework
   - Water Resources Act, 1995
   - Groundwater Regulation (Draft)
   - Irrigation and Drainage Act, 1990
   - Water Supply and Sanitation Policy, 2010
   - (Local Act under proposing) Groundwater Act for Use and Management, that Kassala Groundwater and Wadis Office proposed to Kassala State Government in 2015
(2) Review of organization structure (Federal and State)
   Organization chart, responsibility and mandate, number of staffs, financial conditions, annual budget

1.2 Data Collection
(1) Natural conditions
   Geography, geology, hydrology, hydrogeology, meteorology, natural environment, vegetation, land use and water quality of water resources, etc.
(2) Socio-economic conditions
   Population, household income, agriculture, livestock, industry, national and local budget, etc.
(3) Meteorological, hydrological, and hydrogeological information
   Rainfall, river water level and flow, groundwater level, sediment, water quality, etc.
(4) Water Use and Management Conditions
   Present amount and management system for water use such as irrigation, domestic, livestock, industry, electricity, and navigation
(5) Environmental and social considerations
   Regulation and approval procedure for development, National park, flora and fauna, wild life, historical and cultural property, gender, poverty, water borne diseases, etc.
(6) Existing development plan
   Agriculture, animal resources, urban area, industry, hydropower, navigation, etc.
Existing water resources related facilities such as dams, weirs, and hafirs
Design and existing capacity, discharge, monitoring system, operation and maintenance, etc.

1.3 Preparation of Water Balance Evaluation

1.3.1 Establishment of the Approach and Concept of the Water Balance Study
(1) Nile System
(2) Non-Nile area

1.3.2 Estimation of Current and Future Water Demand
(1) Nile System
(2) Non-Nile area

1.3.3 Geomorphologic and geological /satellite image analysis and mapping
(1) Preparation of geomorphology map
(2) Extraction of lineaments by analysis of satellite image data
(3) Distribution of geology and geological structure
(4) Plotting of observation stations, water use facilities
(5) Delineation of Wadi Sub-Basin
(6) Delineation of Groundwater Basin

1.4 Estimation of Water Resources Potential

1.4.1 Estimation of Water Resources Potential in Nile System

1.4.2 Estimation of Surface Water Resources Potential in Non-Nile area
(1) Rainfall analysis
(2) Evapotranspiration analysis
(3) Runoff modelling
(4) Validation of runoff analysis
(5) Frequency analysis of runoff discharge
(6) Estimation of surface water potential

1.4.3 Estimation of Groundwater Resources Potential in Non-Nile Area
(1) Identification of the aquifers and groundwater basins
(2) Hydrogeological analysis of the aquifers and groundwater basins
(3) Estimation of recharge amount by the aquifers and groundwater basins
(4) Estimation of groundwater potential
(5) Compartmentalisation of the groundwater potential into the Sub-Basin

1.5 Evaluation of Water Balance

1.5.1 Water balance Analysis in Nile System
1.5.2 Water balance Analysis in Non-Nile area
1.5.3 Assessment of Water Balance in consideration of seasonal characteristics
1.5.4 Suggestion on future potential of water resources for Major Cities

1.6 Problem Analysis and Review of Lessons Learnt on Water Resources
   (1) Problem analysis on water resources
   (2) Accumulating lessons learnt of field experiences

1.7 Plan of Local Practice
   (1) Selection of target areas and activities for Local Practice (Component 2)
   (2) Prepare the plan of Local Practice

1.8 Making recommendations for practical strategy, legal and organizational framework for
   promoting IWRM

1.9 Strategic Environmental Assessment and comparative analysis of alternatives for Local Practice

Component 2: Local Practice of IWRM
Local Practice will aim to find lessons learnt to be feedback for practical strategy, legal and
organizational framework for promoting IWRM through the field activities. Entire process of the
activities will be implemented with participatory approach involving stakeholders.

2.1 Identifying present difficulties and its causes

2.2 Propose of countermeasures

2.3 Implementing countermeasures

2.4 Analysis of results of actions and found lessons learnt
6. Description of the project site (maps, environmental and social condition, current issues, etc.)

6.1 Location map
6.2 Environmental and social condition

(1) Geology and topography
The project covers entire land or the Sudan, and its national land area is 1.88 Million km$^2$. The geological formations, which constitute Sudan, are: 1) The basement complex (Precambrian), 2) The older granites (Lower Palaeozoic), 3) Nawa series (Upper Palaeozoic), 4) The Nubian sandstone formation and the Yirol beds of the south Mesozoic, 5) A. Mudic chert (Tertiary), 6) Umm Ruwaba formation consists of River gravels (Quaternary), quartz sand (Sand Dunes), clay plains, Red seaterraces, reefs and Nile valley alluvial.

The topographic features of Sudan are, the Nubian Desert which is part of the Sahara Desert, Qoz Abu Dulu Hills, a hilly region with sand dunes, Dar Hamid (tribal area of Dar Hamid people of Sudan), Jabal Nagashush hills, Jabal Abyad Plateau and the Nuba Mountains in the center of the country.

(2) Land use
The land use of Sudan shares of total land area for three different types of land use: arable land (6.76%) - land cultivated for crops like wheat, maize, and rice that are replanted after each harvest; permanent crops (0.07%) - land cultivated for crops like citrus, coffee, and rubber that are not replanted after each harvest; includes land under flowering shrubs, fruit trees, nut trees, and vines, but excludes land under trees grown for wood or timber; other (93.17) - any land not arable or under permanent crops; includes permanent meadows and pastures, forests and woodlands, built-on areas, roads, barren land, etc.

(3) Meteorology
Average monthly temperatures in Sudan vary between 26°C and 36°C. The hottest areas, where temperatures regularly exceed 40°C, are found in the northern part of the country. The dominant characteristic of Sudan’s climate is a very wide geographical variation in rainfall. In the north, annual precipitation ranges from close to zero near the border with Egypt, to approximately 200 mm around the capital, Khartoum. Sand and dust storms that can cover vast regions and last for days at a time are a defining feature of this low rainfall belt.

(4) Water resources
1) Surface water
Sudan receives the flows of the White Nile from the equatorial lakes region as well as the flows of the Blue Nile and Atbara rising in Ethiopia and in Sudan. These tributaries meet in Sudan, forming the Main Nile, and flow north into Egypt. The total estimated river flow in Sudan is 94.5 Billion Cubic Meter (BCM), and is consisting of 25.5 BCM from White Nile, 54.0 BCM from Blue Nile and 12.0 BCM from Atbara. The Nile Basin constitutes the largest part of the country’s area and a high proportion of the available water resources.
2) Groundwater

Groundwater is the most important water resources in Non-Nile area of Sudan. About 80% of the inhabitants of Sudan depend on groundwater for their living most of the year. The main water-bearing formation in Sudan include; 1) Quaternary to recent surficial deposit, 2) Plio-Pliocene Umm Ruwaba formation, 3) Tertiary basalts, 4) Cretaceous Nubian sandstone formation and 5) Weathered basement complex formation.

(5) Fauna and flora

Vegetation is extremely sparse in the northern desert areas, with most of the substantial forests to be found in central and southern regions. Savannah-type elephant grass covers much of the central steppe region. The river valleys are home to a wide variety of trees, such as acacia, ebony and baobab. Cotton, papyrus, rubber and castor-oil plants are also indigenous to the Nile Basin. All the wild life one expects to find in Africa is present in the Sudan, but mostly in its southern region. Animals include elephants, lions, cheetahs, zebras, hippopotami, buffalo, antelope, rhinoceros, giraffe, various breeds of monkey, crocodiles and a large variety of tropical birds.

(6) Races and Tribes

Sudan has two distinct major cultures--Arab and Black African--with hundreds of ethnic and tribal divisions and language groups, which makes effective collaboration among them a major problem. Most of the Sudanese are Arabic speaking Muslims, although the majority is also use a traditional non-Arabic mother tongue (i.e., Nubian, Beja, Fur, Nuban, Ingessana, etc.). Among these are several distinct tribal groups; the Kababish of northern Kordofan, a camel-raising people; the Ja lin and Shaigiyya groups of settled tribes along the rivers; the seminomadic Baggara of Kordofan and Darfur; the Hamitic Beja in the Red Sea area and Nubians of the northern Nile areas, some of whom have been resettled on the Atbara River; and the Negroid Nuba of southern Kordofan and Fur in the western reaches of the country.

(7) Physical and cultural heritage

Sudan has a rare cultural heritage, much of it derived from the ancient Nubian kingdoms of the Nile Valley which have made it a paradise for archaeologists. Sudan was home to numerous ancient civilizations, such as the Kingdom of Kush, Kerma, Nobatia, Alodia, Makuria, Meroë and others, most of which flourished along the Nile.

6.3 Current issues

The Sudan has suffered from limited water resources such as low annual rainfall less than 500 mm in most of the country and it became constraints for economic development and daily life of people. Water and Sanitation Policy of Northern Sudan, prepared by National Water Corporation in 2010,
analyzed that water demand, 32.1 km$^3$ per year, have already exceeds water resources amount of
the whole country, 29.5 to 31.5 km$^3$ per year. Besides, increasing national population with 3.2% of
annual growth rate put pressure on water balance further.
Water resources unevenly exist in regions in Sudan; Non-Nile area has suffered from water
shortage compared to Nile area. It is one of the main reasons of low access rate of safe water,
55%, in Sudan. Other challenge is water allocation to each water-use sectors. Currently, 90% of
water is consumed for agriculture, then only 3% for drinking water. Another issue is poor water
resources management such as insufficient hydrological observation system for groundwater and
dam operation.

7. Legal Framework of Environmental and Social Considerations

7.1 Organization for Environmental Management

(1) Federal government institutions

The Ministry of Environment and Natural Resources is the main government organization
responsible for protection of environment and resource protection of the Sudan. Under the direct
control of the Minister of Environment and Natural Resources, Higher National Council for
Environment (HNCE) is the Council to evaluate the Environment Impact Assessment (EIA), and
grant the development permit to the applicant (implementation agency).

(2) State government institutions

Based on the Sector Reform with Putting Federal Rule in Force in 1992, the Government of Sudan
has been accelerated the decentralization of environment measure to the state government. Under the sector reform policy, the State Council for Environment (SCE) was established in 6 states of
North Darfur, South Darfur, River Nile, Gedaref, Red Sea and White Nile. The SCE of Kassala
state is being established, and will be established within 2016. In these state, SCE is able to
evaluate EIA and grant the development permit.

7.2 Environmental legislation and policies

(1) Environmental Protection Act (2001)

In Sudan, procedures of environmental and social considerations are carried out based on Environment Protection Act (EPA) established in April 2001, upon revision of Environment and Natural Resources Supreme Council Act (1991). EPA requires implementation of Environmental Impact Assessment (EIA) in any development project. Environmental approval of project is examined based on evaluation of the EIA.

(2) Duties of the competent authority to have due regard to environmental policies
The competent organs shall, upon exercising the functions, or laying down the policies thereof, strive to achieve the following: “Protection, purity, natural equilibrium and preserving the constituents of the environment, or the basic elements and the social and cultural systems thereof, in achievement of safety and sustainable development, for the benefit of generations” (Chapter I, Article 4).

(3) Implementation of EIA and environmental approval
EPA requires implementation of EIA in any development project. Environmental approval of project is examined based on evaluation of the EFS (Chapter III Article 17 (1)).

(4) Contents of EIA
EFS of the project shall show the following:
(1) The expected impact of the proposed project, upon the environment, (2) such negative effects of the project, as may be avoided upon execution of the project, (3) the available alternatives of the proposed project, (4) sufficient explanation that the short term exploitation of the natural resources and the environment does not affect the proffering of such resources, in the long run, etc. (Chapter III Article 17 (2)).

(5) Procedures of Environmental Impact Assessment
EPA requires enforcement of Environmental Impact Assessment (EIA) in any development project.

① Formulation of project plan by the implementing agency
② Implementation of EIA
③ Submission of EIA to SCE or HNCE
④ Evaluation of EIA by the SCE or HNCE
⑤ Approval and grant of development permit
8. Provisional Scoping (Type and Magnitudes of possible adverse impacts and mitigation measures)

Measures for environmental and social considerations must be implemented from an early stage to a monitoring stage. JICA is applying a Strategic Environmental Assessment (SEA) when conducting Master Plan Studies etc., and encourages project proponents etc. to ensure environmental and social considerations from an early stage to a monitoring stage. The SEA is an assessment that is implemented at the policy, planning, and program levels, but not a project-level EIA.

In Sudan, although the idea of SEA is currently not adopted, Ministry of Water Resources, Irrigation and Electricity (MWRIE) and Ministry of Environment, Natural Resources and Physical Development agree to apply the SEA in this project. Therefore, the purpose of environmental and social considerations in this study is to conduct SEA to avoid and/or to minimize significant environmental and social impact caused by the implementation of the project.

 Provisional scoping was done and mitigation measures were proposed for Integrated Water Resources Management projects to be planned by the Project.

| Provisional Scoping |

<table>
<thead>
<tr>
<th>Item</th>
<th>Rating</th>
<th>Rational of Assessment</th>
<th>Forecast Procedure</th>
<th>Mitigation Measure</th>
</tr>
</thead>
</table>
| **[Pollution]**   |        |                                                                                                                                                                                                                      | Collection and review of existing information regarding direction and speed of wind, temperature gradient, previous cases of pollution damage etc. | Re-examination of construction site  
Collection and review of existing information regarding direction and speed of wind, temperature gradient, previous cases of pollution damage etc.  
Prevention of dust pollution by watering etc. |
| Air Pollution     | C−     | A certain amount of air pollutions is expected to be emitted from the use of vehicles and heavy machines during construction work of the facilities                                                                 | Collection and review of existing information regarding direction and speed of wind, temperature gradient, previous cases of pollution damage etc. | Re-examination of construction site  
Collection and review of existing information regarding direction and speed of wind, temperature gradient, previous cases of pollution damage etc.  
Prevention of dust pollution by watering etc. |
| Water Pollution   | C−     | • Temporary impact of water use of surrounding area and/or downstream by the muddy water is expected to be emitted from the construction of river structure or drilling of wells during construction stage.  
• A certain amount of decrease in water quality is expected by decline of groundwater level due to the excess pumping of wells during operation stage. | • Collection and review of existing information regarding water use current water quality and aquatic organism.  
• Survey on water use conditions of existing wells | Re-examination of construction site  
Deliberated construction planning and supervision  
Setting up of the permissible yield and area of influence of groundwater and pumping rate control during the operation. |
<table>
<thead>
<tr>
<th>Item</th>
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<th>Rational of Assessment</th>
<th>Forecast Procedure</th>
<th>Mitigation Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil Contamination</td>
<td>D</td>
<td>The project activities will not induce soil contamination</td>
<td>—</td>
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</tr>
</tbody>
</table>
| Waste                | C−     | Temporary impact of landscape, water quality is expected in case illegal dump of construction debris, surplus earth are dumped illegally into the river or lake during the construction stage. | Collection and review of existing information of the laws and regulations regarding disposal of waste. | • Deliberated construction planning and supervision  
• Securement of disposal field. |
| Noise and Vibration  | C−     | A certain amount of noise and vibration is expected to be emitted from the use of heavy machines during construction work of the facilities.                                                                                   | Collection and review of information regarding distribution of inhabitable area and geological condition etc. | • Change of construction method (e.g. No vibration piling)  
• Coordination of construction timing or working hours.  
• Installation of sound insulating wall shock-absorbing facility. |
| Land Subsidence      | C−     | Excessive pumping during operation more than permissible yield may induce land subsidence in alluvial plain area.                                                                                                   | Collection and review of information regarding groundwater use condition, hydrogeological data and geological conditions of area. | • Setting of permissible yield and pumping rate control during the operation. |
| Offensive Odor       | D      | No impact is expected.                                                                                                                                                                                                 | —                                                                                    | —                                                                                                        |
| Bottom Sediment      | C−     | During operation stage, a certain amount of change of depositional environment and some impact for aquatic organism by the construction of river structure is expected.                                                   | Collection and review of information regarding river bed deposit and aquatic organism. | • Investigation of river bed materials  
• Investigation on aquatic organism  
• Re'examination of construction site  
• Securement of environmental flow. |

**[Natural Environment]**

<table>
<thead>
<tr>
<th>Protected area / Forest</th>
<th>Rating</th>
<th>Rational of Assessment</th>
<th>Forecast Procedure</th>
<th>Mitigation Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C−</td>
<td>Impact for the protected area and/or forest is unknown at this stage.</td>
<td>Collection and review of information and data.</td>
<td>Minimizing the deforestation should be the priority for the planning.</td>
</tr>
<tr>
<td>Ecosystem</td>
<td>C−</td>
<td>A certain level of impact for aquatic organism is expected by the change of nutrient element of sediments due to</td>
<td>Collection and review of the data regarding habitat and</td>
<td>• Adoption of the construction method for the river revetment considering the</td>
</tr>
<tr>
<td>Item</td>
<td>Rating</td>
<td>Rational of Assessment</td>
<td>Forecast Procedure</td>
<td>Mitigation Measure</td>
</tr>
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</tr>
<tr>
<td>Hydrology</td>
<td>B−</td>
<td>the river channel restoration and/or change, flood runoff during the operation.</td>
<td>distribution of aquatic organism, and information related to the similar cases by other water resources management project.</td>
<td>biological environment (e.g. Porosity revetment)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Securement of environmental flow</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Investigation on aquatic organism</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Re'examination of construction site</td>
</tr>
<tr>
<td>Topography and Geology</td>
<td>C−</td>
<td>Development of water resources for the irrigation and/or domestic water might cause impact for existing water use of rivers and groundwater during operation.</td>
<td>Collection and review of the data and information regarding groundwater level and river flow rate.</td>
<td>• Securement of environmental flow and observation of flow rate of the river.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Setting of permissible yield and pumping rate control during the operation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Figure the forest preservation plan on the water resources management plan in order to stabilize river channel and groundwater recharge.</td>
</tr>
<tr>
<td>Groundwater</td>
<td>B−</td>
<td>A certain level of impact for the topography of the surrounding area is expected in case large scale excavation and/or banking by the construction of river structure.</td>
<td>Collection and review of the data and information regarding topography, geology and geography.</td>
<td>• Abstraction of the area to be protected from the impact by the change of topography by examination of topographical and geological information during planning stage.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Setting of permissible yield and pumping rate control during the operation</td>
</tr>
<tr>
<td>Involuntary Resettlement</td>
<td>B−</td>
<td>Excessive pumping during operation might cause decline of groundwater level and impact for the groundwater use in surrounding area during operation.</td>
<td>Collection and review of the data and information regarding groundwater level, geology and groundwater use.</td>
<td>• The idea and measure for avoiding/minimizing involuntary resettlement should be the priority for the</td>
</tr>
</tbody>
</table>

【Social Environment】

- Construction of dams and river improvement might cause involuntary resettlement.
- Collection and review of the data and information regarding the previous cases of involuntary resettlement.
<table>
<thead>
<tr>
<th>Item</th>
<th>Rating</th>
<th>Rational of Assessment</th>
<th>Forecast Procedure</th>
<th>Mitigation Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local economy such as employment and livelihood etc.</td>
<td>B+</td>
<td>Integrated water resources management will contribute the economic activities of the community.</td>
<td></td>
<td>involuntary resettlement.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Development the dialogue mechanism with resident, and disclosure of information.</td>
</tr>
<tr>
<td>Cultural heritage</td>
<td>C−</td>
<td>Impact for the cultural heritage is unknown at this stage.</td>
<td>Collection and review of the data and information related to the cultural heritage.</td>
<td>Preservation of the cultural heritage should be the priority for the planning.</td>
</tr>
<tr>
<td>Landscape</td>
<td>C−</td>
<td>Impact for the landscape is unknown at this stage.</td>
<td>Collection and review of the data and information related to the landscape.</td>
<td>Preparation of the facility plan considering the landscape of surrounding area.</td>
</tr>
<tr>
<td>Ethnic minorities, indigenous peoples and poverty group</td>
<td>C−</td>
<td>Impact for the Ethnic minorities and indigenous peoples is unknown at this stage.</td>
<td>Collection and review of the data and information related to the Ethnic minorities and indigenous peoples.</td>
<td>• The idea and measure for avoiding/minimizing involuntary resettlement should be the priority for the planning.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Development of economic activity by the integrated water resources management will contribute the improvement of work environment.</td>
<td></td>
<td>• Development the dialogue mechanism with resident, and disclosure of information.</td>
</tr>
<tr>
<td>Working conditions (including occupational safety)</td>
<td>C+</td>
<td>Development of economic activity by the integrated water resources management will contribute the improvement of work environment.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water use</td>
<td>B+</td>
<td>Water use permit will be appropriately managed by the Integrated Water Resources Management activities.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accidents</td>
<td>C−</td>
<td>Increase of traffic of construction vehicles during construction lead to the</td>
<td>Collection and review of the information</td>
<td>Provision of rate limit and make caution to the people at the school,</td>
</tr>
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<tr>
<td>Item</td>
<td>Rating</td>
<td>Rational of Assessment</td>
<td>Forecast Procedure</td>
<td>Mitigation Measure</td>
</tr>
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<td>-------------------------------------------</td>
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<td>-----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Land use and utilization of local resources</td>
<td>B+</td>
<td>Effective land use and utilization of regional water use will be planned by the Integrated Water Resources Management activities.</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Existing infrastructures and social services</td>
<td>C+</td>
<td>In case the flood control countermeasures are planned as the water resources management plan, the Existing infrastructures and social services will be protected by the plan.</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Social capitals and decision-making institutions</td>
<td>C+</td>
<td>Positive impact is expected, because the countermeasures of water resources management will be proposed to the water users level.</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Imbalance of costs and benefits</td>
<td>D</td>
<td>The proposed plans by the project will not induce imbalance of costs and benefits, because the participatory consensus formation process is adopted for the planning process.</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Local conflict</td>
<td>D</td>
<td>The proposed plans by the project will not induce the local conflict, because the participatory consensus formation process is adopted for the planning process.</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Gender equality</td>
<td>D</td>
<td>No impact is expected</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Infectious diseases HIV/AIDS</td>
<td>C−</td>
<td>A certain level of spread of infection diseases is expected by the increase of site worker for the construction</td>
<td>Collection and review of the data and information regarding the Infection diseases /HIV/AIDS.</td>
<td>Make caution to the people at the residential area.</td>
</tr>
<tr>
<td>Climate change</td>
<td>D</td>
<td>It is expected that the plans induce the climate change is not formulated As the countermeasure of the water resources management.</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

Note 1) The items are selected based on the JICA Guidelines for Environmental and Social Considerations (April,
Note 2) Rating:
A: Significant impact is expected (+: Positive impact, -: Negative impact)
B: Some impact is expected (+: Positive impact, -: Negative impact)
C: Extent of impact is unknown, further examination will be required (+: Positive impact, -: Negative impact)
D: No impact is expected

9. Alternatives to the project activities including “without project” option

The project is to enhance the sustainable utilization of surface water and groundwater for domestic, industrial, irrigation, hydropower and navigation purpose through IWRM (Integrated Water Resources Management) related activities by the Project. Without IWRM process, development of water resources and water use will be obliged to be implemented in haphazard and uncoordinated manner. Such implementation manner may further deteriorate the sustainability of the water resources of Sudan and complicate relationship among Nile riparian countries.

Alternatives related to sub-project selection cannot be proposed in this stage because the water potential-demand balance in nationwide is not evaluated and the challenges on water resources are not identified currently. Alternatives need to be examined in the Project.

10. Result of the consultation with recipient government on environmental and social consideration including roles and responsibilities

Ministry of Water Resources, Irrigation and Electricity (MWRIE) and Ministry of Environment, Natural Resources and Physical Development (MENRPD) will abide by ‘JICA Guidelines for Environmental and Social Considerations’ in order to ensure that appropriate considerations will be made for the environmental and social impacts of the Project.

11. Terms of reference for environmental and social considerations

The Government of Sudan side agrees that the Project should include Terms of Reference (TOR) for Environmental and Social Considerations in line with the JICA Guidelines for Environmental and Social Considerations (April 2010) (hereinafter referred to as “JICA Environmental Guidelines), as follows:

Terms of Reference

Environmental and Social Considerations Study
1. Review of existing development plans, development projects, studies, and public and private investments;

2. Analysis to identify constraints to development and factors of promoting development;

3. Analysis of alternatives for achieving the goals of the Project;

4. Consideration of contents of Master Plan which is to be developed in the Project;

5. Conducting baseline surveys for Environmental and Social Considerations, including:
   1) Collecting information on federal and state laws, regulations and standards on environmental and social considerations, such as environmental impact assessment, pollution control, resettlement, public participation, information disclosure to the public, etc.
   2) Confirming legal framework and both federal and state institutions in Sudan on environmental and social considerations.
   3) Review of the previous Strategic Environmental Assessment (SEA) Study reports and/or experiences which were conducted in Sudan development projects.
   4) Gap analysis between these legal frameworks and JICA Environmental Guidelines.
   5) Survey on designated national parks, other protected areas, habitats of wildlife and plants, cultural heritages by federal or state government in and near the geothermal sites and the associated transmission line routes
   6) Survey on issues related to social considerations such as land use, rural communities, poor, ethnic minorities and indigenous peoples, economic and industrial activities in and near the areas relating to Master Plan.

6. Scoping on possible environmental and social impacts, focusing on the Items related to the “Pollution”, “Natural Environment” and “Social Environment” (clarification of extremely important items on environmental and social impacts and its evaluation methods at the time of decision-making of Master Plan);

7. Initial Environmental Examinations (IEE) survey on the proposed projects of Master Plan;

8. Prediction and evaluation of the impact of the proposed projects and comparative analysis of alternatives of proposed projects, including zero-option scenario, based on the concept of Strategic Environmental Assessment;

9. Examination of mitigation measures to avoid, minimize and compensate the negative impacts of
the project;

10. Examination of monitoring plans for the project, including monitoring items, frequencies and methods;

11. Support to hold stakeholder meetings and information disclosure.

12. Other relevant information

None